SMS Alternative 4: MDN-to-MSID Translation at the NP SCP

Alternative 4 requires that the NP SCP contains MDN-to-MSID translations. The MDN-to-MSID translations need to be maintained and administered by the regional NPAC-SMSs. Updates for the translation may use the same method defined for MDN-to-LRN translations.

This scheme requires the originating system to query the NP SCP for an MDN-to-MSID translation. Then, the originating system routes the short message to the destination home system using the MSID provided in the query response.

In the event that the dialed MDN is not within the coverage area of the regional NPAC-SMS, originating system may have to query an NP SCP that contains the data for the region of the dialed MDN or query an NP SCP that contains nationwide NP data.

The first figure illustrates the call flow for the scenario when the MSC queries the NP SCP for the called party's MSID and the second figure shows the call flow for the MC querying the NP SCP.

Figure 3-11 Alternative 4 for WNP SMS Delivery
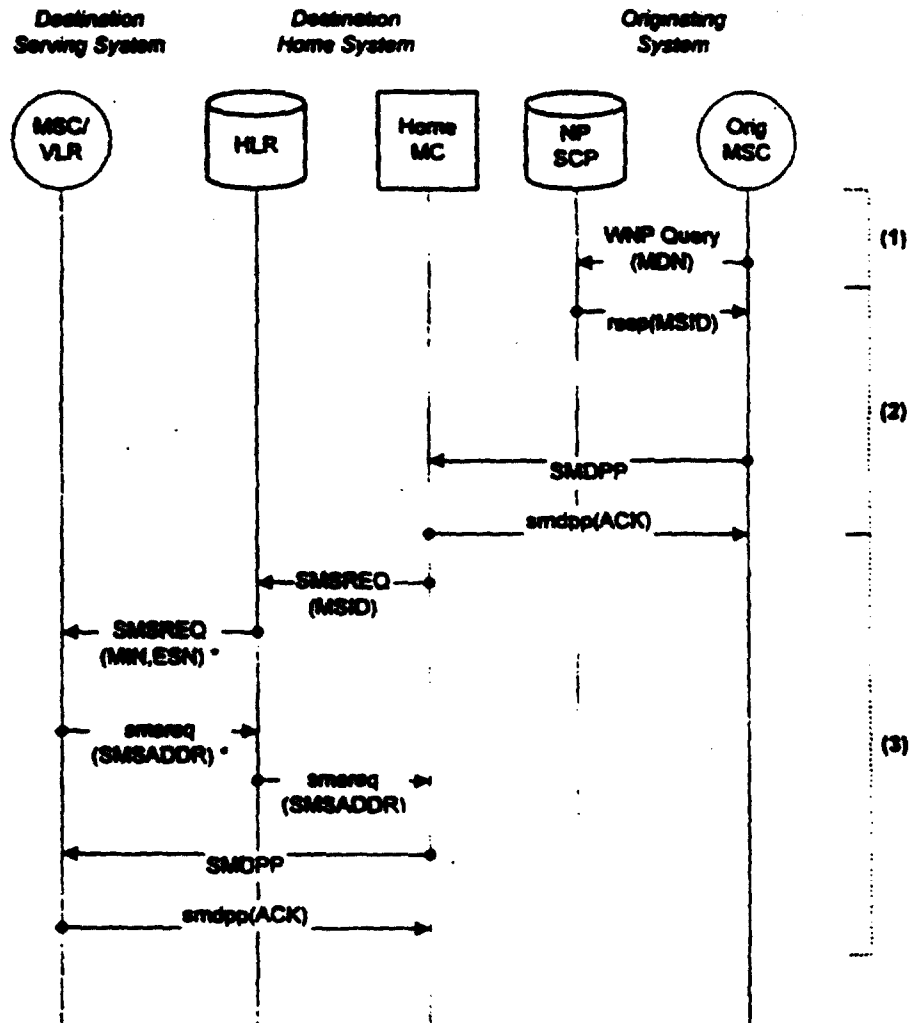
* These messages are sent if the HLR does not hav a current temporary SMS routing address.

The detailed steps are as follows:

(1) The MSC of the originating system queries the NP SCP with the dialed MDN. The N! SCP responds to the query with the MSID associated with the dialed MDN.

(2) The originating system routes the SMDPP message to the destination home MC using the MSID.

(3) When the destination home MC receives the SMDPP request, it delivers the short message following existing procedures.

The advantages of Alternative 4 are as follows:

- The existing MSC-NP SCP interface can be used for the MDN-to-LRN translation to support SMS, although it is defined call routing.

- The MSID-to-MC translation can be used to route short messages to the destination home MC.

The disadvantages of Alternative 4 are as follows:

- NP SCP, local SMS and NPAC-SMS need to support the MDN-to-MSID translations for all wireless subscribers within its region.

- The MSC or the MC need to have the capability to query the NP SCP for an MSID.

- The NP SCP query element needs new protocol.

- Under scenario B where message routing is through the originator's home MC, if the originator's MSC is performing the NP SCP query for an MSID, the originator's MSC needs to forward the MSID to the originator's home MC.

The following items with regard to Alternative 4 should be further investigated:

- Since NPAC-SMSs only contain regional data, it is foreseeable that a query may be launched to an NP SCP that only contain data from the region it is in. Thus, it may be preferable to have the MDN-to-MSID translations for wireless subscribers available nationwide.

- International roaming may require this alternative to have a gateway MSC to launch a query to the NP SCP for the MSID of the called party or may require the foreign countr to query the NP SCP.

SMS Alternative 5 - 10-digit GTT at the NP SCP

In alternative 5, the originating MSC or MC routes an SMS Delivery Point to Point (SMDPP) message to called party's home destination MC via a 10-digit GTT at the NP SCP. When the short message arrives at the STP, a 6-digit MDN-to-NP SCP GTT is performed. This may nee a new translation type (TT) to forward the message to the NP SCP. Then, the NP SCP maps tr MDN to its associated LRN and the incoming translation type to an outgoing translation type l LRN-to-MC translation. The NP SCP relays the short message to the destination MC via a 6-digit LRN-to-MC GTT at an STP.

Figure 3-12 Alternative 5 for SMS Delivery
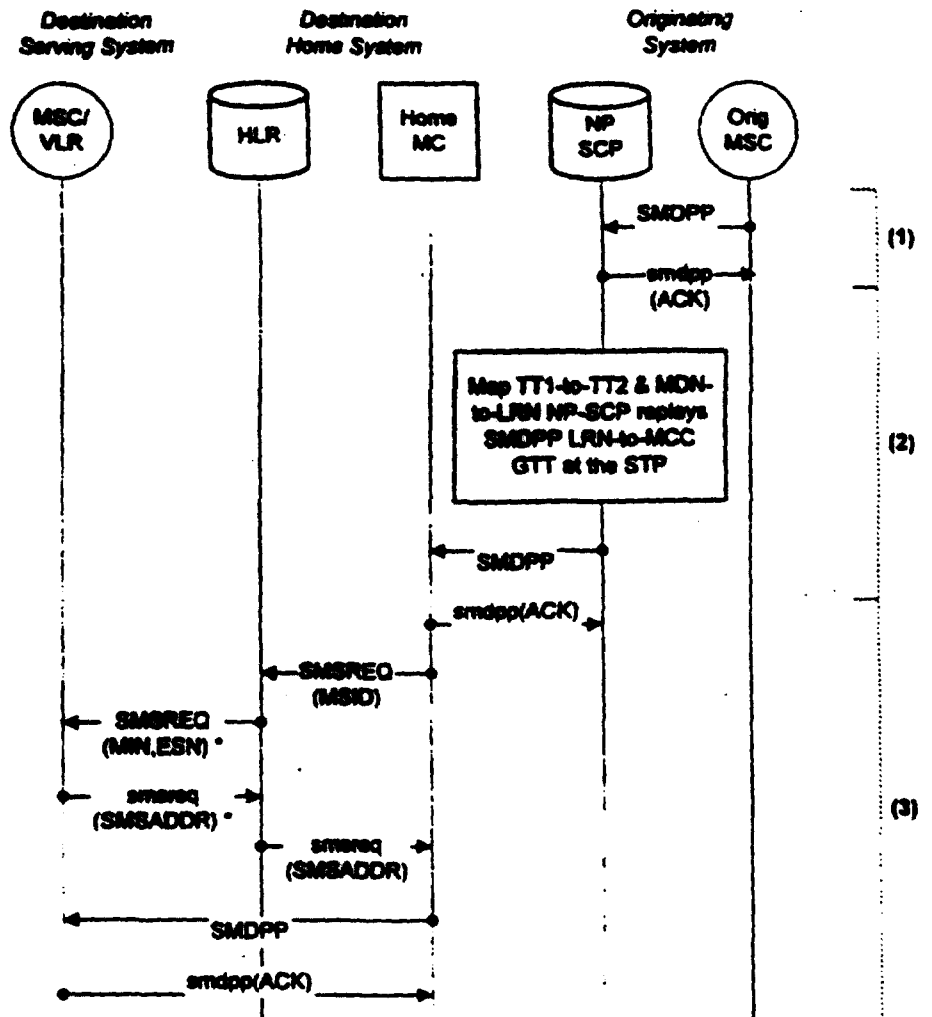
* These messages are sent if the HLR does not hav a current temporary SMS routing address.

The detailed steps are as follows:

(1) The originating MSC or MC routes the SMDPP to the destination MC.

(2) The STP performs a 6-digit MDN-to-NP SCP translation for SMS. When the NP SC receives the message, it translates the incoming translation type (TT1) to an outgoing translation type (TT2) and maps the MDN to its associated LRN. The NP SCP relay

short message to the destination MC. Then. the STP performs a 6-digit LRN-to-MC translation to route the message to the destination MC.

(3) When the destination home MC receives the SMDPP request. it delivers the short message following existing procedures.

The advantages of Alternative 5 are as follows:

- Step 2 uses the same 10-digit intermediate GTT at the NP SCP process that the wirelin industry is developing/investigating for the support of services such as CLASS. Inter-switch Voice Messaging, Calling Name, and ABS/LIDB.

- The NP SCP does not need to maintain additional routing information for SMS.

- Short messages from other countries will be delivered to the destination home MC usil this alternative.

- 10-digit intermediate GTT at the NP SCP is more efficient than querying the NP SCP : the LRN.

The disadvantages of Alternative 5 are as follows:

- The NP SCP needs to the have the capability to perform a 10-digit intermediate GTT ε the SCCP level.

- There is a need for two new translation types; one for MDN-to-NP SCP (MC) translat and the other for the LRN-to-MC translation.

- Administration for the point code of MCs used for the LRN-to-MC GTT will be need

The following items with regard to Alternative 5 should be further investigated:
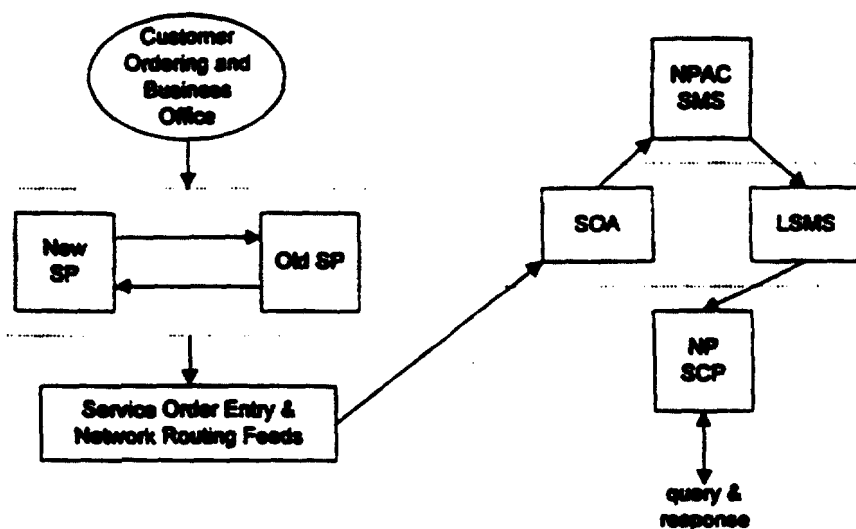
- None identified.

4.   BUSINESS SYSTEMS, OPERATION SYSTEMS AND BILLING

4.1   Service Order and Provisioning

4.1.1   *Process Flow Overview*

Figure 4-1 below illustrates the overall information sharing process for portability.[31]

Figure 4-1   Service Order and Provisioning Process Flow

The NPAC-SMS is an administration center developed, owned and operated by a neutral, third party company (i.e., neutral to all telecommunications service providers). It collects and disseminates information that maps ported subscribers to service providers in a geographic area Presently, seven geographic areas have been agreed upon[32] for covering the United States, with areas roughly corresponding to the state boundaries associated with the seven Regional Bell Operating Companies (RBOC).

The LSMS is logical Operations Systems (OS) function that accepts downloads from the NPAC SMS and disseminates the data to the NP-SCPs. This logical function could be a stand-alone system on the WSP premise, an application within another OS, or function provided by another company. A WSP can deploy a single LSMS, LSMSs per NPAC-SMS or LSMSs per NP-SCP;

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[31] *North American Numbering Council LNP Architecture and Administrative Plan*, Issue 5, March 4, 1997.

[32] ibid.

this deployment will depend upon the WSPs infrastructure. NP-SCP platform deployment, ar network coverage area.

The Service Order Activation (SOA) function is similar to the LSMS in that it is a function which ties the NPAC-SMS with the WSPs service order processing systems. As with the LSI this function could be a physically separate system or a function within another system.

The interface between the NPAC-SMS and the LSMS is an open interface based upon the Common Management Information Protocol (CMIP). This interface, including the CMIP objects, is currently documented in various locations, mostly on a state or regional basis: and objects can vary among the NPAC-SMSs. However, the NANC NP Working Group is prese looking into creating a single interface document for all of the regions.

The interface between the NPAC-SMS and the SOA is also a CMIP-based interface and similarly documented.

The interface between the LSMS and the NP-SCP as well as the between the SOA and the WSP's Service Order Entry systems is at the discretion of the WSP.

The processes by which these systems communicate information is discussed below.

4.1.2 *Provisioning a Number Block Open for Portability*

Once a number block opens for portability, every telecommunications provider within the re serving that block must provision the block as open within its switches. More specifically, a WSP must populate the appropriate number portability tables in the MSC with the open NPA NXX so that the NP trigger will trigger the query upon detecting that a called party number': NPA-NXX matches this open NPA-NXX. All open blocks served within the region must be provisioned in the MSC. The determination of how many or few open blocks are provision a single MSC is at the discretion of the WSP depending upon the architecture deployed by th WSP balanced with the responsibility of supporting WNP per the FCC order and this docum

The source for open number blocks will be the LERG. The means for notification is still to determined. The format of the information will be in NPA-NXX blocks.

4.1.3 *Notifying the Receipt of a Ported Subscriber*

The process of notifying the receipt of a port subscriber involves (a) notifying the NPAC-SI the new LRN for the DN so that it can broadcast the new LRN to all SPs within the region, a (b) coordinating the change with the old SP (e.g., service activation, line side provisioning).

A standard process definition is currently being worked by the NANC NP Working Group b upon efforts by various states in defining the flow. This document will not attempt to descri the details of these flows and urges WSPs to review and comment on the work in progress.

The essence of this flow, however, can be described at a high level:

(a) The New SP receives written authorization regarding the subscriber's intention to port.

(b) The New SP communicates the port to the Old SP via an Electronic Data Interchange (EDI) interface.

(c) The Old SP confirms the receipt of notification

(d) The New SP (and optionally the Old SP) notifies the NPAC-SMS of the new LRN for the DN via the SOA.

(e) The New SP and the Old SP coordinate the activation date and line side provisioning (automated and manual processes are being defined).

(f) The subscriber is activated.

(g) The NPAC-SMS downloads the new LRN to all LSMSs. All SPs update their NP-SCP with the data in the LSMS.

(h) Calls route to the new, ported subscriber per the WNP Solution.

Although simplified, one can realize the complex yet crucial coordination that must occur between two SPs. In fact, the lines of communication (manual and/or electronic) must be established between every SP (wireline and wireless, alike).

4.1.4 Downloading data from the NPAC-SMS

The NPAC-SMS holds the master copy of the mapping from DN to LRNs as it is the center which notifies all SPs of a subscriber's new LRN when the subscriber ports.

The point in the process in which the download occurs can be seen as step (g) above. As with the above process description, many states have documented their defined version of the content of the NPAC-SMS and the CMIP interface (including objects) between the regional NPAC-SN and the LSMS. As a result, currently seven versions of the interface exist. However, the NAN NP Working Group has taken on the effort to arrive at a single, standard NPAC-SMS set of objects. WSPs are urged to become involved and comment on these efforts.

Besides downloading the data to the NP-SCP (e.g., DN to LRN mapping), the NPAC-SMS is being designed to have the capability to download the necessary data for the GTT functions required for number portability. More about this download can be found in documents which describe the NPAC-SMS and its interface.

4.1.5   Auditing the NPAC-SMS Data

Along with defining a process by which data is delivered to or received from the NPAC-SMS into an SPs systems, an audit function is being defined to allow for SPs to validate the content of the database at periodic intervals.

4.2   Number Administration

4.2.1   IMSI, MIN and MDN Administration

MDNs are NANP numbers and should be administered as today's wireless directory numbers administered today.

IMSIs are assigned by the Bellcore Numbering Consulting Group (NCG) upon carrier request and in accordance with the *IMSI Assignment Guidelines and Procedures*, Version 1. February 12, 1996. For WSPs that choose to deploy IMSI MSIDs, they must plan for and implement a administration process for obtaining, assigning, maintaining, and aging as appropriate IMSIs.

In WNP the assignment and management of MINs as MSIDs is yet to be determined. As with IMSIs, WSPs using MINs as MSIDs must plan for and implement an administration process f obtaining, assigning, maintaining and aging as appropriate MINs. The WNP Solution assume that the MINs used by WSPs today for dialable numbers will be retained by the WSPs for MS usage.

4.2.2   Disconnected Numbers

When a wireless subscriber terminates service (i.e. does not port but rather drops service altogether), the WSP may choose to provide intercept treatment. During this period, no chang are indicated to the NPAC-SMS and calls will continue to be routed to the WSP.

During this time, the service provider may offer standard or custom intercept treatment for ca to this number. After the period of providing intercept expires, the serving WSP then notifier NPAC-SMS that the portable number entry should be removed. The number reverts to the service provider which was allocated the NPA-NXX associated with the freed number.

4.2.3   Location Routing Number Assignments to WSP

In order to receive calls for ported subscribers within a serving area, a WSP needs assigned at least one LRN within that serving area. A WSP may designate a single MSC in the serving at as a single point of entry for incoming calls (e.g., a gateway MSC). In this case, the gateway MSC would require at least one LRN value for other networks to route calls. Once the MSC receives the call; it may invoke existing wireless procedures for obtaining a temporary routin number to complete the call. The MSCs behind the gateway do not require LRNs.

Alternatively, a WSP may choose to allocate at least one LRN for every MSC in the serving which would result in routing calls to various MSCs and eliminating the concept of a gatewr MSC. If multiple MSCs share the same code block (i.e., NPA-NXX), then a unique LRN is needed to identify each MSC. Either method is acceptable and at the discretion of the WSP.

Assigning an LRN to an MSC may require that the MSC be listed in the LERG. A majority MSCs are currently not LERG-listed. The exact impact requires further study.
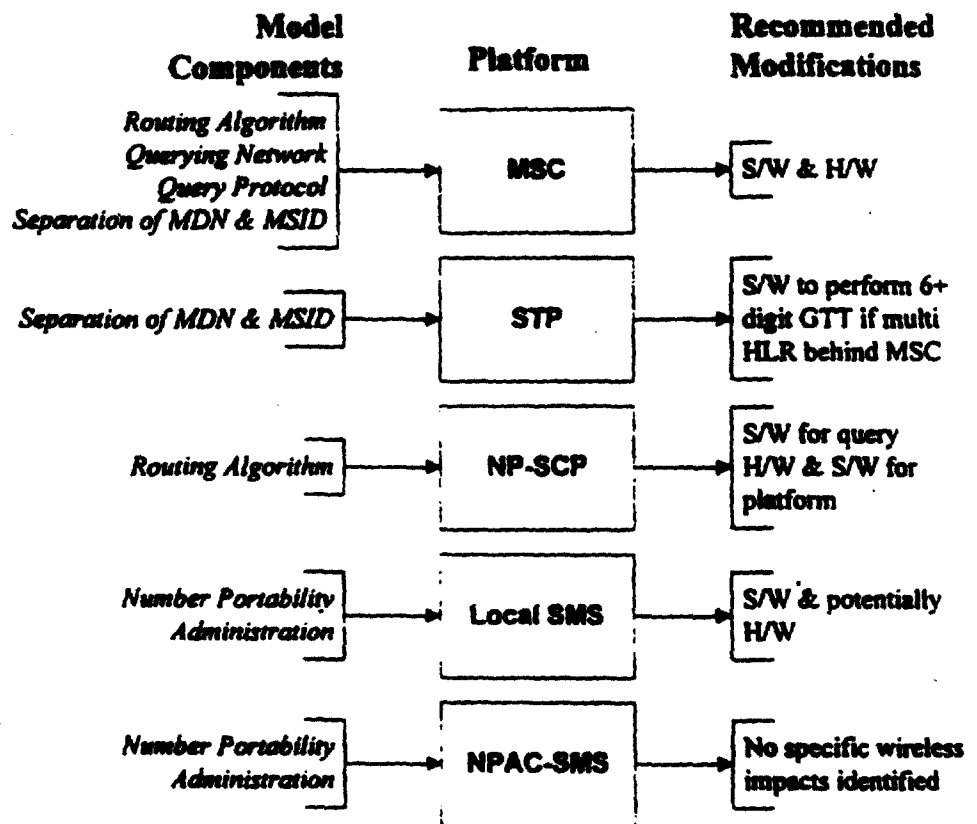
4.3   Billing

The impacts and processes regarding billing, including clearinghouse reconciliation, have n been identified at this time for WNP. However, the separation of the MDN and MSID, allo the MSID to identify the WSP with the first six digits should alleviate some of the impacts t such things as the roaming tables. Additionally, discussions have been held regarding the addition of some billing parameter (probably not dependent on MIN, IMSI, nor MDN and y be defined) which might help identify the service provider for the calling record.

5. WIRELESS NUMBER PORTABILITY SYSTEM IMPACTS

This section summarized the anticipated WNP architecture impacts to each of the entities in the network architecture.

Figure 5-1 below maps the components of the wireless number portability building blocks in Figure 2-1 to the wireless NP platforms (e.g., network elements, operations systems). Most platforms map to only one building block; the exception is the MSC as it maps to multiple. figure also illustrates the recommended modifications related to each platform.

Figure 5-1   Mapping of Platforms to Wireless Number Portability Model

Model Components	Platform	Recommended Modifications
Routing Algorithm *Querying Network* *Query Protocol* *Separation of MDN & MSID*	MSC	S/W & H/W
Separation of MDN & MSID	STP	S/W to perform 6+ digit GTT if multi HLR behind MSC
Routing Algorithm	NP-SCP	S/W for query H/W & S/W for platform
Number Portability Administration	Local SMS	S/W & potentially H/W
Number Portability Administration	NPAC-SMS	No specific wireless impacts identified

5.1 Impacts to the Mobile Station

The following impacts are anticipated on the MSs:

- Because the solution separates the MSID from the MDN, the MS will need to contain both the MDN and the MSID. This implies both IMSI (if IMSI capable) as well as the MIN (as long as MIN is used as an MSID).

- The MS will register with the IMSI on an IMSI capable network or with the MIN on MIN-capable networks. If the mobile is not IMSI-capable, it will register with MIN on IMSI or MIN networks.

- It will be desirable for the phones to display the MDN or nothing instead of the MSID when the subscriber powers on his/her phone.

- Porting from one SP to another SP may require that the mobile station be reprogramme: with a MIN or an IMSI as appropriate to the recipient provider. The impacts of portability on pseudo-IMSI mobile stations will require further study.

5.2   Impacts to the Air Interfaces

No impacts have been identified for the following air interface protocols: IS-136, IS-95 and GSM.

However, if a provider chooses to implement an IMSI network, the following impacts should b known (and is being worked on by the IS-136 standards committees):

- In the IS-136A standards, if both an IMSI and a MIN are programmed in the mobile, th MIN takes precedence over the IMSI while in the mobile's home country. Therefore, modifications to the standard are required in order to reverse the precedence, allowing IMSI to be the primary identifier in an IMSI-capable network.

5.3   Impacts to IS-41 Signaling

The following impacts to the IS-41 signaling standards are anticipated:

- All IS-41 messages which contain MIN (e.g., Registration Notification) will need to b enhanced to support MSID.

- The contents of the dialed digits parameter in the IS-41 messages (e.g., LocationRequest) will be the MDN instead of the MIN.

- IS-41 will need to be enhanced to support Automatic Code Gap (ACG), particularly tc the NP-SCP.

- A query must be defined and documented. This could be either an existing, a modifie or a new IS-41 message.

- The IS-41 Location Request Return Results message should be modified in order to distinguish whether the destination digits are a TLDN or another type of digits (e.g. C Forwarding digits).

- MIN is currently a mandatory parameter in the SMSREQ message. For SMS in WNP the appropriate value (for what is a MIN today) will be the MDN. The SMSREQ message should be modified to require the MDN.

5.4   Impacts to GSM Signaling

The GSM signaling modifications to support WNP involve two areas. The first area involves ISUP which should be based on the same modifications adopted for wireline portability. Thes include the following[33]:

- new FCI bit indication for translated number

- new GAP code point to indicate Called Party Number

The other change involves the Mobile Application Part (MAP) protocol which is a specific ty of TCAP protocol. The changes include the following:

- a definition of a query message and response

- incorporation of ACG protocol and procedures

5.5   Impacts to the Home Location Register

The WNP architecture notes the following impacts on the HLR:

- The HLR must provide a mapping between the MSID and the MDN for all subscriber

- The MDN should be made available to the MSC/VLR at the time of registration for a subscribers.

- If multiple MDNs are used for the same MSID, the HLR must designate one MDN as preferred MDN for the domestic network.

- The HLR must support any enhancements to the IS-41 (or equivalent) messages requ to accommodate MSID, MIN, MDN, and IMSI, as appropriate.

5.6   Impacts to the Mobile Switching Center

The MSC is impacted in multiple areas including registration/validation, call origination, call delivery, roamer tables, digit screening, query capabilities, and others. Some of these items a detailed below.

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[33] CCPN SS7 network capability in *T1 LB 557 Signaling System Number 7-Number Portability Call Completion to a Port Number - Integrated Text* currently in ballot to become an American National Standard

To ensure the Calling Number Identification Presentation (CNIP) service continues to deliver the appropriate number to the called party the MSC must populate the calling party number parameter with the MDN in the ISUP IAM.

5.6.1 Registration/Validation

The impacts on the MSC due to the proposed WNP architecture, pertaining to the MS registration and validation, are the following:

- The MSC must support (or at least portions of) IS-41 Revision C (or equivalent) protoco for the Mobile Application Part if the MSC is to perform NP functions.

- The MSC must send the registration request to the HLR requiring GTT of the MSID digits at the STPs.

  - IMSI will use a TT of 9, and MIN will use a TT of 3.

  - IS-41 Revision C must be modified to include the MSID in place of the MIN as a mandatory parameter in the RegistrationNotification message.

- The MSC will receive an HLR response to the registration/validation message which is MTP routed from the HLR. The profile macro in the response message must include the DN of the MS.

- The MSC must be able to differentiate between MSID and MDN and to store them in th call register.

5.6.2 Call Origination

The impacts on the MSC due to the proposed WNP architecture, pertaining to the MS call origination, are the following:

- The originating MSC must populate the CgPN in the ISUP IAM with the MDN. This MDN is obtained from MS's HLR in the response to the registration response.

- The originating MSC must populate the Charge Party Number in the ISUP IAM with th MDN. This DN is obtained from MS's HLR in the response to the registration response

- If the CdPN belongs to a ported NPA-NXX block, then the following must hold true:

  - The MSC must have a trigger for the NP-SCP query when the MSC determines that the call is intra-LATA and non-local. The MSC will query the NP-SCP using the WNP Query message to obtain the LRN of the entry switch of the ported number.

  - The MSC must be able to interpret the response received from the NP-SCP. The response contains the LRN for ported DNs and the dialed DN for non-ported DNs.

- Upon receiving the LRN, the MSC must send an ISUP IAM message, to the next switch with the mth bit set in the FCI, the CdPN set to the retrieved LRN, the Cgl set to the MDN of the calling party, and the GAP parameters set to the dialed DN

- If the MDN is not ported, the NP-SCP will respond with the CdPN parameter set the dialed DN in the response message. The MSC must be able to process this message.

- If MSC determines that it is an inter-LATA call, it must route the call to the appropriate IXC for further processing using ISUP or Multi-Frequency (MF) trur set up messages. The IXC may then perform the query to the NP-SCP.

5.6.3 Call Delivery

The impacts on the MSC due to the proposed WNP architecture, pertaining to the MS call delivery, are the following:

- The MSC must be able to process the IAM parameters, including the FCI mth bit and GAP.

- The MSC pointed to by the LRN (i.e., entry MSC) must recognize the LRN in the Cc as its own. It must then replace the CdPN value with the GAP value. This new CdPI will then be processed by the MSC as usual.

  The MSC will send a query to its HLR based on the MDN received from the ISL message. Since the MDN is different from MSID and since multiple HLRs may support be supported at the MSC (for some networks), a special translation of the DN may be needed to locate the HLR.

- When setting up the trunk to the Serving network, the MSC must populate the IAM message with the CdPN equal to the TLDN, the GAP equal to the MDN, and the FC indicator as set (no query is necessary during this leg of the call).

- If the call is forwarded to another number, the entry MSC must treat the forwarded number as a new dialed number and follow the LRN solution. Thus, if the forwarde number is within a ported range, the MSC will query the NP-SCP to get the LRN of destination switch.

5.7 Impacts to Interconnection Types

There are two basic types of interconnection used by wireless carriers for interconnecting wi the PSTN[34] [35], Type 1 and Type 2. Type 1 and Type 2 trunks can be used for interchanging

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[34] EIA/TIA IS-93 *Cellular Radio Telecommunications A_r-D_i Interfaces Standard*

[35] Bellcore GR-145 *Compatibility Information for WSP-LEC Interconnection*

traffic in both directions, i.e. wireless-to-wireline and wireline-to-wireless. A description of these interconnection types and the impacts of WNP follows.

5.7.1 Type 1

Type 1 interconnection is a trunk interconnection between an MSC and a wireline End Office switch and can support interchange of traffic between the MSC and the PSTN. This includes traffic to and from customers served by that Type 1 office, traffic to and from other end offices and MSCs in the local network, and traffic to and from long distance carriers. Type 1 trunks als support interchange of other types of traffic (i.e., ancillary traffic) such as operator services, directory assistance, and emergency service access (i.e., 911).

Since Type 1 trunks are configured as trunks with line treatment (TWLT) at the Type 1 end office, they can only support MF or ISDN access signaling and not SS7 ISUP signaling. Therefore, the substitution of the LRN in the CdPN, and the use of the FCI and GAP parameter proposed in the SS7 ISUP IAM for NP cannot be supported by Type 1 trunks. Consequently, providers using Type 1 trunks for wireless-to-wireline calls following an NP-SCP query by an MSC will lose the benefit of the query.

Type 1 trunks can continue to be used for wireless-to-wireline calls (including wireless-to-wireless via the wireline) in an NP environment in the following instances:

(a) where a WSP establishes a business agreement with the Type 1 service provider to perform the NP queries,

(b) for calls to non-ported NPA-NXXs.

(c) for long distance calls where the IXC, and not the Type 1 service provider, would perform the NP query, and

(d) for ancillary services such as operator services, directory assistance, and emergency service access.

Type 1 trunks can also continue to be used for wireline-to-wireless calls (including wireless-to wireless via the wireline) in an NP environment where there exist no ported numbers within th entire NPA-NXX in the WSP's Type 1 number range.

If type 1 interconnects are to be replaced with an interconnection type such as type 2A-SS7 to support the LRN call routing method, the MSC will need to be re-homed from the end office t an access tandem.

5.7.2 Type 2

There are multiple Type 2 interconnections, i.e. Type 2A, 2B, 2C & 2D.

- Type 2A interconnection is a trunk interconnection between an MSC and a wireline tandem switch, and can support interchange of traffic between the MSC and the PST This can include traffic to and from end offices and other MSCs served by that Type tandem switch, and traffic to and from long distance carriers if the Type 2A tandem serves as an access tandem. Type 2A trunks can operate with MF or SS7 ISUP signaling. To support NP, Type 2A trunks must be converted to SS7 ISUP in order t able to send and receive the LRN in the CdPN, and the FCI and GAP parameters in tl SS7 ISUP IAM.

- Type 2B interconnection is a trunk interconnection between an MSC and a wireline e office switch, and can support interchange of traffic between the MSC and only customers served by that Type 2B office. Type 2B trunks can operate with MF or SS ISUP signaling and are usually provisioned to allow overflow traffic to route to an associated Type 2A trunk group. To support NP, Type 2B trunks can remain MF as as none of the NPA-NXXs served by the Type 2B end office or MSC contain any po numbers. Further, the Type 2B end office and MSC can perform an NP-SCP query the result indicating that the call should be routed to a Type 2B trunk group. Again, signaling can still be used in such cases as long as the Type 2B end office and MSC retain the LRN for use with the associated Type 2A overflow trunk group, should all the Type 2B trunks be found busy. Type 2B trunks can be converted to SS7 ISUP ar optionally arranged for sending and receiving the LRN in the CdPN, and the FCI and GAP parameters in the SS7 ISUP IAM.

  WSPs can make business arrangements for another provider to query and properly r the call to the ported-to network.

- Type 2C interconnection is a trunk interconnection between an MSC and an E911 tandem for Emergency Service calls. Signaling over Type 2C trunks is not impacted WNP. Emergency Services feature interactions with WNP are covered in section 3.3

- Type 2D interconnection is a trunk interconnection between an MSC and an Operato Tandem. Signaling over Type 2D trunks is not impacted by WNP. Operator Service feature interactions with WNP are covered in section 3.3.1.

5.8   Impacts to the Signaling Transfer Point

Note: It is recommended that all service providers utilize the GTT capability at their STPs f routing SS7 queries. Although MTP routing capability can be used, it will not be able to util all of the performance and administrative benefits of GTT.

The proposed NP architecture will have the following impacts on the STPs in the SS7 backb network:

- If STP GTT is used, STPs must support a new TT value for routing messages to the WNP query messages to the NP-SCP. Wireless networks, for WNP queries, should use the same TT values as used in the wireline networks. [36]

- The STPs shall perform appropriate SS7 route and SCCP management for routing queries.

- If IMSI is implemented, the STPs must support GTT of IMSI for the new IMSI TT. Although IMSI has 15 digits, the STPs may need to perform GTT only 6-digit GTT on IMSI to locate the home service provider's network. If the home network supports multiple HLRs for the same mobile network code of the IMSI, it may have to perform GTT on greater than 6-digits of the IMSI in order to locate the HLR for the MS. Only the IMSI digits needed to perform GTT are required in the SCCP CdPA. The complete IMSI value used by the end application should be provided in the TCAP.

- STPs must have route-sets defined for every possible destination network with which the service provider has a roaming agreement.

- STPs should be able to support DN-to-HLR routing translation based on a new intra-network TT yet to be defined.

- STPs will perform Intermediate GTT (IGTT) for messages to remote network nodes and Final GTT (FGTT) for routing to the local network nodes.

5.9 Impacts to Global Title Translation

The impacts below apply to the location of GTT databases within a network. These impacts on apply to networks that plan to use GTT for the routing and management of query messages.

- The NP-GTT database is a six-digit GTT database located on the STP.

- It is perceived that MSID GTTs are STP based and are not impacted by number portability.

- MDN GTTs for inter-network service and capabilities are the most impacted in a numb portability environment. Much discussion has occurred on whether to locate the MDN GTT database on the STP or on the NP-SCP. Regardless of location, MDN-GTTs may require interrogation of the TCAP portion of the message to complete the GTT lookup. A local SMS interface may be beneficial depending on the volume of updates received The local SMS would provide updates for ported numbers. It is up to each service provider to update their default GTT databases for each inter-network service via existing service provider procedures.

- MDN-GTTs and the associated TCAP interrogation may be provided on STPs. The STPs provide GTT load sharing of queries to application SCPs and STPs. The STPs

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[36] A current move is underway to have separate NP TTs for each protocol as opposed to one TT for all three (i.e., AIN, IN, a WIN).

provide SCCP management in the case of application failures. Service providers need to ensure correct and timely provisioning to avoid circular routing conditions between STPs performing GTT.

- MDN-GTTs on the SCP and the associated TCAP interrogation may be provided on NP-SCP (or other SCP) platform. The NP-SCPs should provide load sharing of queries to application SCPs and Gateway STPs as necessary. The SCPs should also provide SCCP management in the case of application failures. Service providers need to ensure correct and timely provisioning to avoid circular routing conditions between STPs performing GTT and between STPs and SCPs performing GTT.

- MDN-GTTs on the SCP require a six-digit GTT database on the STP for each GTT database located on the SCP. This service provider managed database is used by the STP to locate the SCP performing the ten-digit GTT.

  Another option is to follow a capability being studied by some land-line service providers. This is a capability where the NP-SCP changes the TT value and CdPA of GTT messages. This scenario requires a six-digit GTT at the STP, a ten-digit GTT at the NP-SCP where a second TT value is reassigned and the changing of the CdPA to the LRN. A service provider that receives these messages from another network is required to support the new TT value and service based LRN database. Each receiving network i required to have and maintain this database for this scenario to be successful.

5.10 Impacts to the Number Portability Service Control Point

The WNP solution will have the following impacts on the NP-SCP (some of which are already known in the LRN solution):

- The NP-SCP must support WNP query messages from wireless network and a response message including the LRN of the ported subscriber's MSC.

- NP-SCPs should be deployed with redundant replicates for total availability. This will require synchronization of the data in all replicated units to be provided by a centralize service management system.

- NP-SCPs should comply with Bellcore GR-1280-CORE, AIN SCP Generic Requirements, Section 11. Requirement 11-4 demands that the Mean Response Time i the rated transaction load be 100 ms or less, and the 95% response time be 120 ms or less.

- The NP-SCP should implement congestion control and indicate such a condition to MSCs via ACG as to defined by IS-41 and/or GSM standards.

5.11 Impacts to Customer Care and Provisioning

The following list describes the potential impact of NP on customer care and provisioning systems, depending upon a service provider's infrastructure:

- Some system in the Customer Acquisition/Care provisioning stream must interface to tl regional SMS for negotiating/announcing ported numbers with the other service provider(s) and for querying existing subscriber records.

- Any system which interfaces with the regional SMS system must do so with the enhanced format of the Customer Account Record Exchange (CARE), also known as tl Inter-Service Provider Maintenance, Administration, and Provisioning (ISPMAP) information.

5.12   Impacts to Billing

The following list describes the potential impact of NP on billing and fraud management systems.

- Roaming tables may need to be modified to support both IMSI and MIN. If the billing systems store IMSI, standard call records will also need to be modified and expanded. Additionally, telephone inventory records must be modified.

- Billing systems will most likely need to support more than one identifier for a subscriber: MIN, IMSI, and/or MDN.

- Any system or process which is built on MIN must be modified to support another ID · rating, cycle changes, splits, et al.

- Fraud Management will also be impacted for the same reason as above. Call Detail Records from the visited service providers are currently extracted on the basis of NPA· NXX translation of the billed number.

- A billing module may have to be added to the existing AMA records for calls involvin ported numbers. The details are for future study.

- A billing identifier may be added to the call setup or AMA records. Future study is required.

- Call data message handling (e.g.. IS-124) needs must be addressed.

5.13   Impacts to Maintenance

The following list describes the potential impact of NP on the maintenance operations:

- Performance and measurements

- Fault Detection, isolation and recovery

- Alarm detection and alarm reporting

- Maintenance and administration position

- Test procedures of the non-ported number, ported number and disconnected ported number

5.14 Impacts to Number Portability Data Administration

The following list describes the potential impact of NP on customer and network data administration.

- Service providers need to have an EDI interface for exchanging ported subscriber's d

- WSPs must provide for ar LSMS function to mediate the data sent from the NPAC-S to the NP-SCP, including the CMIP interface to the NPAC-SMS.

- WSPs must provide for an SOA function to mediate the data sent from the WSP's service order entry systems to the NPAC-SMS, including the CMIP interface to the NPAC-SMS.

- The CTIA Cellular Operations Record Distribution (CORD) and the LERG data distribution procedure must be updated to provide rapid exchange of PC/SSN, MIN, other pertinent routing and subscription information.

- WSPs must provide for a means (e.g., an Operations Support System, manual) with which to provision network data, including

  - portable NPA-NXX block indicator for the MSCs,

  - new TT and new GTTs in the STPs,

  - HLR updates to include ported numbers, and

  - translation data in NP-SCP.

5.15 Impacts to Service and Network Reliability

The porting of a customer from one service provider to another requires provisioning change that are both accurate, timely, and precisely coordinated between all service providers in a portable area. This provisioning is especially critical with respect to GTT databases. Incorr provisioned GTT databases can result in SCCP circular routing conditions that may utilize al a link set's capacity within seconds. A circular routing mechanism is therefore needed that eliminates SCCP circular routed messages from occurring.

ANSI T1.112 provides procedures for SCCP message looping in the form of the SCCP Hop Counter. This hop counter is available in SCCP X-Unitdata (XUDT) messages only. Netwc elements will require upgrades to support XUDT message formats. Due to economics and desired dates of implementation, the UDT message will be used for number portability and existing applications. The XUDT message has been flagged as the desired long term solutio

5.16 Human Factors Impacts

Today, mobile subscribers may dial seven digits for calls within their home NPA. An NPA is pre-pended to the dialed digits for some mobile originated calls. In a Number Portability environment, 10 digits must be sent in the query to the NP-SCP. Wireless Number Portability driving the separation of MSID and MDN, with the possibility that the MSID (as MIN) will no reflect the NPA of the subscriber's MDN.

The question then is how will the MSC determine what NPA to pre-pend to a 7 digit dialed number. The call might be misrouted, or the wrong information sent to the NP-SCP, if the MS relies on the MIN MSID or the NPA of the MSC to determine the NPA of the called number.

There are 3 possible solutions:

(a) Require 10 digit local dialing for all mobile subscribers. This would treated all mobil subscribers equally (whether ported or non-ported) but may put the wireless carrier th implements 10 digit local dialing at a competitive disadvantage if the other local carri wireless or wireline, still support 7 digit local dialing. (A variation would be to have only the ported subscriber dial 10 digits. But that disadvantages that subscriber, woul not meet dialing parity criteria, and would require the carrier to maintain multiple dial plans for different classes of subscriber.)

(b) Assign the ported subscriber an MSID in MIN format with the same NPA as the porte MDN. It is not clear if this would always be possible, and this practice may affect MSID administration and may lead to inefficient use of the MSID. (MIN administrati is for further study.) If the mobile subscriber has an IMSI as MSID, and no MIN, the MSID provides no value for this process since an IMSI does not contain an NPA.

(c) Use the NPA of the MDN of the calling mobile subscriber. This solution assumes tha the calling party's MDN is available at the time of this substitution.

5.17 Service Impacts

The following impacts to services, as known today, are anticipated with the introduction of number portability as proposed in this document:

- Over the Air Activation must support the delivery of a MDN to the MS.

  The User Initiated Over The Air Function (OTAF) will not have impact with Call Origination on Wireless Number Portability. The Network Initiated OTAF with Call Termination will have some impact on Wireless Number Portability.

- CNIP must support the delivery of the MDN and not the MIN as the call party numb for mobile originated calls.

- Emergency services must ensure that the subscriber is known to the operator by the MDN and not the MSID. Refer to section 3.3.2 for further discussion.

- Delivery of an SMS message to the Destination MC and ultimately the mobile station is based upon the MIN. In WNP, the delivery network only has the MDN of the mobile station. Therefore, the service is impacted in routing to the Destination MC. Refer to section 3.3.5 for presented solutions.

Impacts to CLASS type services are similar to those outlined in the ICCF document "INC Repor on Number Portability," section 13.1.5.1.

There may also exist impacts to proprietary service implementations not appropriate for this document.

6.   RELATED DOCUMENTS

The following documents can provide additional information regarding Number Portability:

- *Industry Numbering Committee (INC) Report on Number portability, Industry Servic providers Compatibility Forum (ICCF)*, INC 96-0607-013, July 11, 1996.

- *FCC First Report and Order and Further Notice of Proposed Rulemaking*, FCC 96-: June 27, 1996.

- *Federal Communications Commission (FCC) Notice of Proposed Rulemaking (NPR for the Local Number Portability*, Docket Number 95-116, July 13, 1995.

- *Generic Requirements for SCP Application and GTT Function for Number Portabili* Illinois Number Portability Workshop, Issue 0.95, September 4, 1996.

- *Generic Switching and Signaling Requirements for Number Portability*, Illinois Nur Portability Workshop, Issue 1.02, June 17, 1996.

- *CCPN*, T1 Letter Ballot 557

- *IMSI Assignment Guidelines and Procedures*, Version 1, February 12, 1996.

- *North American Numbering Council LNP Architecture and Administrative Plan*, Iss March 4, 1997.

- *T1 LB 557 Signaling System Number 7-Number Portability Call Completion to a Portable Number - Integrated Text*, currently in ballot to become an American Nati Standard

Information is available via the World Wide Web regarding number portability. In some ca: the above mentioned document may be found at these web sites.

- *www.fcc.gov* - information regarding the NANC LNP activities, FCC orders, meeti etc.

- *www.ported.com* - this site contains various documents and information related to wireline portability.

- *www.t1.org/index/0701.htm* - this site contains, among many other things, the CCPN document.

7. ISSUES

The following issues are currently being or must be investigated before implementing the W
Solution:

(a) How many LRNs will be assigned per MSC -- one per serving area, one per POP/P(
one per NPA-NXX, one per MSC, and/or one per MC (if multiple MCs are associat
with an MSC)?

(b) Are there any methods wireless could employ for more efficient routing.

The following text was submitted as contribution to this document but has not been
agreed upon:

"Call routing for mobile to mobile calls can be more efficient if the
originating wireless network can identify that the outgoing call is wireless.
There are two options for identifying a wireless call:

- The Originating MSC could maintain a list of LRNs assigned to MSCs. Af
the MSC receives the LRN in the WNP Query Response, the MSC can che(
see if the LRN is assigned to an MSC.

- A wireless indicator could be maintained in the NP-SCP. The indicator wo
be returned in the WNP Query Response along with the LRN. This option
requires significant effort and corporation with all industry providers.

An originating MSC, upon identifying an outgoing wireless call, may route a
Location Request message to the called party's HLR using a 6-digit LRN to
HLR GTT a the STP or per internal translations. (Note: If there are
multiple HLRs, either the MSC has multiple LRNs or more than 6-digits
may be needed for the GTT.) If the called party is roaming, the HLR will
return the TLDN in the location request return result message. The
originating MSC can route the call using the TLDN."

(c) The impact of WNP with regard to Emergency Callback whether the call back is ov
roamer access port or otherwise requires further study.

(d) Performance and capacity impacts should be studied.

(e) How will MINs be administered?

(f) It may be assumed that providing resellers with numbers in and of itself does not r
these numbers ported (and thus have LRNs assigned in the NP database). Howeve
what if a reseller wishes to resell off a different facility provider and still retain its